WHAT IS CLAIMED IS:

1. An internal combustion engine that compresses an air-fuel mixture containing a fuel and the air in a combustion chamber and makes the compressed air-fuel mixture subjected to combustion, so as to output power, said internal combustion engine comprising:

an air-fuel mixture compression mechanism that compresses the air-fuel mixture in said combustion chamber;

a first fuel-air mixture production module that produces a first fuel-air mixture containing a first fuel and the air at a specific ratio, which avoids auto ignition of the first fuel-air mixture through the compression by said air-fuel mixture compression mechanism, in said combustion chamber;

a second fuel-air mixture production module that supplies a second fuel, which is different from the first fuel, into a partial area of said combustion chamber, so as to produce a second fuel-air mixture; and

an ignition module that ignites the second fuel-air mixture, so as to compress and auto-ignite the first fuel-air mixture.

2. An internal combustion engine in accordance with claim 1, wherein said second fuel-air mixture production module injects, as the second fuel, a fuel having a higher octane value than that of the first fuel, so as to produce

the second fuel-air mixture.

3. An internal combustion engine in accordance with claim 1, wherein said second fuel-air mixture production module injects, as the second fuel, a combustible gas, so as to produce the second fuel-air mixture.

4. An internal combustion engine in accordance with claim 2, wherein said second fuel-air mixture production module injects, as the second fuel, hydrogen gas, so as to produce the second fuel-air mixture.

5. An internal combustion engine in accordance with claim 1, wherein said second fuel-air mixture production module injects, as the second fuel, an alcohol, so as to produce the second fuel-air mixture.

6. An internal combustion engine in accordance with claim 5, wherein the second fuel is methyl alcohol.

7. An internal combustion engine in accordance with claim 1, said internal combustion engine further comprising:

a third fuel-air mixture production module that produces a third fuel-air mixture containing the first fuel and the air at a preset ratio, which allows for auto ignition of the third fuel-air mixture through compression by said air-fuel mixture compression mechanism, in said

combustion chamber;

a required torque detection module that detects a required torque to be output from said internal combustion engine; and

a fuel-air mixture production control module that, when the detected required torque is not greater than a predetermined threshold value, prohibits operations of said first fuel-air mixture production module and said second fuel-air mixture production module.

8. An internal combustion engine in accordance with claim 1, said internal combustion engine further comprising:

a third fuel-air mixture production module that produces a third fuel-air mixture containing the first fuel and the air at a preset ratio, which allows for auto ignition of the third fuel-air mixture through compression by said air-fuel mixture compression mechanism, in said combustion chamber;

a required torque detection module that detects a required torque to be output from said internal combustion engine; and

a fuel-air mixture production prohibition module that, when the detected required torque exceeds a predetermined threshold value, prohibits operations of said third fuel-air mixture production module.

9. An internal combustion engine in accordance with

claim 1, said internal combustion engine further comprising:

a third fuel-air mixture production module that produces a third fuel-air mixture containing the first fuel and the air at a preset ratio, which allows for auto ignition of the third fuel-air mixture through compression by said air-fuel mixture compression mechanism, in said combustion chamber;

a required torque detection module that detects a required torque to be output from said internal combustion engine; and

a fuel-air mixture production control module that, when the detected required torque is not greater than a predetermined threshold value, prohibits operations of said first fuel-air mixture production module and said second fuel-air mixture production module, and when the detected required torque exceeds the predetermined threshold value, prohibits operations of said third fuel-air mixture production module.

10. An internal combustion engine in accordance with claim 9, wherein said fuel-air mixture production control module prohibits operations of said ignition module, when the detected required torque is not greater than the predetermined threshold value.

11. An internal combustion engine in accordance with claim 3, said internal combustion engine further

comprising:

a cylinder injection valve that directly injects the second fuel into said combustion chamber,

wherein said fuel-air mixture compression mechanism rotates a crankshaft to lift a piston up in said combustion chamber, thereby compressing the air-fuel mixture in said combustion chamber, and

said second fuel-air mixture production module makes the second fuel injected from said cylinder injection valve to produce the second fuel-air mixture in a preset term from 30 degrees as a rotational angle of said crankshaft prior to a top dead center in a compression cycle, at which said piston reaches its maximum height after compression of the air-fuel mixture, to the top dead center in the compression cycle.

12. An internal combustion engine in accordance with claim 11, wherein a recess is formed on a top face of said piston, where the second fuel injected from said cylinder injection valve forms the second fuel-air mixture.

13. An internal combustion engine in accordance with claim 12, wherein said recess is located on a substantial center on the top face of said piston.

14. An internal combustion engine in accordance with claim 12, wherein said recess has a rim defined by a side wall of said recess crossing the top face of said piston

to at least partly form a sharp edge.

15. An internal combustion engine in accordance with claim 12, wherein a second recess is formed at a specific position, which faces said recess formed on the top face of said piston, on an inner face of said combustion chamber opposed to the top face of said piston.

16. An internal combustion engine in accordance with claim 12, wherein the top face of said piston has a guide groove to guide the second fuel injected from said cylinder injection valve to said recess.

17. An internal combustion engine in accordance with claim 11, wherein said second fuel-air mixture production module makes the second fuel injected from said cylinder injection valve to produce the second fuel-air mixture at a certain time specified relative to an ignition timing of the second fuel-air mixture by said ignition module.

18. An internal combustion engine in accordance with claim 17, said internal combustion engine further comprising:

a delay factor detection module that detects a factor of delaying an ignition timing; and

an ignition timing delay module that, when the detected factor reaches or exceeds a preset level, delays the ignition timing of the second fuel-air mixture,

wherein said second fuel-air mixture production module comprises a production timing delay module that delays an injection timing of the second fuel, in combination with a delay of the ignition timing, so as to delay a production timing of the second fuel-air mixture.

19. An internal combustion engine in accordance with claim 18, wherein the delay factor detected by said delay factor detection module is either of a frequency of occurrence of knocking in said internal combustion engine and a concentration of nitrogen oxides included in an exhaust gas discharged from said combustion chamber.

20. An internal combustion engine in accordance with claim 5, said internal combustion engine further comprising:

a cylinder injection valve that directly injects the second fuel into said combustion chamber,

wherein said fuel-air mixture compression mechanism rotates a crankshaft to lift a piston up in said combustion chamber, thereby compressing the air-fuel mixture in said combustion chamber, and

said second fuel-air mixture production module makes the second fuel injected from said cylinder injection valve to produce the second fuel-air mixture in a preset term from 90 degrees as a rotational angle of said crankshaft prior to a top dead center in a compression cycle, at which said piston reaches its maximum height after

compression of the air-fuel mixture, to 30 degrees as a rotational angle of said crankshaft prior to the top dead center in the compression cycle.

21. An internal combustion engine in accordance with claim 1, said internal combustion engine comprising:

an intake conduit, which a flow of the air supplied into said combustion chamber passes through;

an intake valve that opens and closes said intake conduit,

wherein said first fuel-air mixture production module makes the first fuel injected into said intake conduit upstream said intake valve to produce the first fuel-air mixture, and

said second fuel-air mixture production module makes the second fuel injected into said combustion chamber to produce the second fuel-air mixture.

22. An internal combustion engine in accordance with claim 1, said internal combustion engine comprising:

an exhaust conduit, which a flow of an exhaust gas discharged from said combustion chamber passes through;

a conversion catalyst that is disposed in said exhaust conduit to convert a harmful component included in the exhaust gas; and

a catalyst warm-up module that makes the second fuel injected from an upstream side of said conversion catalyst into said exhaust conduit and ignites the injected second

fuel, so as to warm said conversion catalyst up.

23. An internal combustion engine in accordance with claim 1, wherein said air-fuel mixture compression mechanism rotates a crankshaft to lift a piston up in said combustion chamber, thereby compressing the air-fuel mixture in said combustion chamber,

said internal combustion engine further comprising:

an intake valve that opens and closes an intake conduit, which a flow of the air supplied into said combustion chamber passes through, synchronously with the rotation of said crankshaft;

an exhaust valve that opens and closes an exhaust conduit, which a flow of an exhaust gas discharged from said combustion chamber passes through, synchronously with the rotation of said crankshaft;

a drive mode changeover module that varies open and close timings of said intake valve and said exhaust valve and thereby changes over a drive mode of said internal combustion engine between a 4-cycle drive mode and a 2-cycle drive mode; and

a rotation speed measurement module that measures a rotation speed of said crankshaft; and

a drive control module that controls said drive mode changeover module to make said internal combustion engine driven in the 4-cycle drive mode when the measured rotation speed is not greater than a predetermined threshold value, while making said internal combustion engine driven in the

2-cycle drive mode when the measured rotation speed exceeds the predetermined threshold value.

24. An internal combustion engine in accordance with claim 23, said internal combustion engine further comprising:

an intake valve actuation module that carries out at least either one of a supply and a cutoff of electric power, so as to open and close said intake valve; and

an exhaust valve actuation module that carries out at least either one of a supply and a cutoff of electric power, so as to open and close said exhaust valve,

wherein said drive mode changeover module control at least either one of a supply timing and a cutoff timing of the electric power to said intake valve actuation module and to said exhaust valve actuation module, thereby changing over the drive mode of said internal combustion engine.

25. A control apparatus for an internal combustion engine, which compresses an air-fuel mixture containing a fuel and the air in a combustion chamber and makes the compressed air-fuel mixture subjected to combustion, so as to output power,

said control apparatus comprising:

a first fuel-air mixture production module that produces a first fuel-air mixture containing a first fuel and the air at a specific ratio, which avoids auto ignition

of the first fuel-air mixture through the compression, in said combustion chamber;

a second fuel-air mixture production module that supplies a second fuel, which is different from the first fuel, into a partial area of said combustion chamber, so as to produce a second fuel-air mixture; and

an ignition module that ignites the second fuel-air mixture, so as to compress and auto-ignite the first fuel-air mixture.

26. A control method of an internal combustion engine, which compresses an air-fuel mixture containing a fuel and the air in a combustion chamber and makes the compressed air-fuel mixture subjected to combustion, so as to output power, said control method comprising:

a first step of producing a first fuel-air mixture containing a first fuel and the air at a specific ratio, which avoids auto ignition of the first fuel-air mixture through the compression, in said combustion chamber;

a second step of supplying a second fuel, which is different from the first fuel, into a partial area of said combustion chamber, so as to produce a second fuel-air mixture; and

a third step of igniting the second fuel-air mixture, so as to compress and auto-ignite the first fuel-air mixture.

27. A control method in accordance with claim 26,

wherein said second step injects, as the second fuel, a fuel having a higher octane value than that of the first fuel, so as to produce the second fuel-air mixture.

28. A control method in accordance with claim 26, wherein said second step injects, as the second fuel, a combustible gas, so as to produce the second fuel-air mixture.

29. A control method in accordance with claim 26, wherein said second step injects, as the second fuel, an alcohol, so as to produce the second fuel-air mixture.